ethnography. The authoctonous population of the Philippines, the Negritos, were driven back by two Malay invasions, and are now to be found only in isolated remnants scattered throughout the islands of the archipelago. By the first invasion the Negritos were forced from the coast into the interior, where they remained undisturbed until the second Malay irruption. This drove the first Malay invaders in their turn from the coast, and the descendants of the new comers still occupy the ports and harbours to this day. The Negritos were either destroyed by wars with the first Malays, or completely absorbed by marriage with them, that now no tribes of them are to be found. The Malays of the first invasion came from Borneo, and are found to-day in the mountain districts of Luzon, under various tribal names, such as the Tingianes, Igorrotos, Guinanes, Apayos, Abacas, Calnigas, Gaddanes, &c.; while the second invaders, now known as Tagals, Pampangos, Visayas, Ilocanes, Cagayanes, &c., inhabit the coast regions, where they were found by the Spaniards in the third quarter of the sixteenth century. Naturally the various tribes were unable to prevent being influenced by each other, as well as from without, and to this we must attribute similarities in many respects, and especially in religion, which mark the Malays of the whole archipelago. Allowance too has to be made for the influence of the Chinese, perhaps also of the Japanese, on the tribes living on the coast long prior to the Spanish invasion. The inhabitants of the coast, the Malays of the second invasion, for the most part profess Christianity now, and are well known, but the pagans of the interior, the Borneo Malays, who, according to Prof. Blumentritt's theory, formed the first invasion, have never been thoroughly investigated, and this circumstance led Dr. Meyer to spend three months among the Igorrotos. The appendix in which he records his observations is very full. It discusses the name and extent of the Igorrotos, their territory, and its climate, their build, mode of dressing the hair, and tattooing (which is far more elaborate than that of even the Japanese grooms, and is probably the most complicated in the world), their dress, ornaments, weapons, villages, huts, agriculture, and cattle-breeding, food, and drink, domestic utensils, art, tools; customs at birth, and marriage, and death; their priests and religion; head-hunting, war customs, festivals, language, modes of reckoning time and numbers, and their myths and sagas. Finally comes Dr. Virchow's account of an Igorroto skull, and a brief vocabulary. It is this portion of the work which renders it one of scientific interest, and prevents it from being a mere amusing account of the modern grand tour. The numerous illustrations which it contains of the tattooing ornaments, utensils, and the like, add greatly to its value. The Igorrotos are among the disappearing peoples of the earth. They leave the impression of having once possessed a higher culture; their manufactures now are far below those of even half a century ago, and Dr. Meyer thinks that, like every primitive race brought into direct contact with European civilisation, nothing can save them from ultimate extinction.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

Molecular Dynamics

I THINK there must be some mistake in Prof. Forbes' report of Sir Wm. Thomson's remarks as quoted in NATURE of last week (p. 461) upon the rate of wave-propagation on Maxwell's electro-magnetic theory of light. From the end of the last quotation one would suppose that Sir Wm. Thomson intended to convey that the rate of wave-propagation that Maxwell's theory asserted to be the same as that of light, was the rate of propagation of a variation of a current in a conducting wire. Now Sir Wm. Thomson cannot, I am sure, have intended to convey any such mistaken notion. Maxwell carefully guards against any such mistake by pointing out that conduction of electricity is of the nature of diffusion, and not of a wave-propagation, and so has no definite velocity. What Maxwell has calculated is the rate of propagation of disturbances in *non-conductors*, and not in conductors. It is the rate at which the disturbances, produced in the way considered by Sir Wm. Thomson in the preceding part of this quotation, would be propagated by transverse vibrations. Of course, as Sir Wm Thomson asserts, something analogous to a longitudinal vibration may co-exist with these, but Maxwell's theory shows that a medium which would transmit only transverse vibrations would explain electric and magnetic phenomena.

GEO. FRAS. FITZGERALD

40, Trinity College, Dublin, March 23

[The passage quoted by Mr. Forbes is correctly reported. A more full explanation of this subject will be found in Nichol's "Cyclopædia," second edition, 1860, article, "Electricity, velocity of;" reprinted in vol. ii., art. lxxxi., of my collected mathematical and physical papers.—W. T.]

Civilisation and Eyesight

HAVING read with much interest the recent correspondence in NATURE on this subject, I am forwarding the results of some observations which I recently made to determine the degree of acuteness of vision possessed by the natives of the islands of Bougainville Straits, in the Solomon Group.

I examined the powers of vision of twenty-two individuals who were in all cases either young adults or of an age not much beyond thirty. For this purpose I employed the square test-dots which are used in examining the sight of recruits for the British army, and I obtained the following results:—Two natives could distinguish the dots clearly at 70 feet, one at 67 feet, two at 65 feet, three at 62 feet, four at 60 feet, two at 55 feet, three at 52 feet, four at 50 feet, and one at 35 feet. The conclusion at which I arrived was that 60 feet represented the average distance at which a native could count the dots—a distance rather greater than that at which they should be placed to test the normal powers of vision, viz. 57 feet.

Of these twenty-two natives I came upon only one whose vision seemed at all defective. In this instance—that of a man about thirty years old—the nature of the cause was sufficiently indicated by the prominence of the eyes and the nipping of the lids, especially when the sight was strained by trying to count the test-dots at a distance. The limit of distance at which this man could count the test-dots was 35 feet. The question which presented itself to my mind in this case was, whether a white man who could count the dots at the same distance—viz. 35 feet—would exhibit to the same degree the external signs of myopia. I might put this query into other words, and ask whether, considering the far-seeing powers of these natives, the peculiar external signs of myopia would not appear with a less degree of this defect than with the white man.

Natives of these islands are very quick at perceiving distant objects, such as ships at sea. I was often much impressed by their facility in picking out pigeons and opossums, which were almost concealed in the dense foliage of the trees some 60 or 70 feet overhead. My attention was not attracted by the unusual size of the pupils; the eyes, however, have a soft, fawn-like appearance with but little expression. In conclusion, I may refer to the circumstance that the interiors of their houses are always kept dark, the door being usually the only aperture admitting light. The object is, I belive, to exclude flies and other insects from their dwellings. Coming in from the direct sunlight, I have often had to wait a minute or two before my eyes became accustomed to the change; but the natives do not experience this inconvenience. Some hours of the day they commonly spend in their houses, while at night they use no artificial light except the fitful glare of a wood fire. It would seem probable that the influence of the opposite conditions, presented by the bright sunlight and the darkness of their dwellings, would be found in the increased rapidity of the contraction and dilatation of the pupil with the enlargement, perhaps, of the

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retinal receiving area. It is, however, a noteworthy circumstance that these natives are able to pass from the bright tropical glare outside their dwellings to the dark interiors, and *vice versâ*, without showing the temporary derangement of vision which the white man experiences whilst the iris is adapting itself to the new condition.
H. B. GUPPY

17, Wood Lane, Falmouth, March 30

Mr. Lowne on the Morphology of Insects' Eyes

IN reference to the discussion between Dr. Sydney Hickson and Mr. Benjamin Lowne, I beg to state that I have been favoured by both of those gentlemen with opportunities of carefully studying their preparations, and I feel it to be my duty to state that in my judgment Mr. Lowne's preparations do not justify the conclusions which he has based on them, and are, in fact, not made with that skill and knowledge of modern histological method which is necessary in order that trustworthy conclusions may be obtained. On the other hand, Dr. Hickson's preparations are thoroughly satisfactory as examples of histological manipulation. Dr. Hickson supports the accepted view as to the termination of the optic nerve-fibres in the nerve-end cells of the retinulæ. Mr. Lowne denies this connection. I have no doubt that such a connection cannot be readily observed in Mr. Lowne's preparations. At the same time I have no doubt whatever that this is because the preparations are badly made. Mr. Lowne's preparations fail to show many other simple features in the structure of the insect's eye, which are readily seen in preparations made by the application of methods now recognised and approved, but not made use of by Mr. Lowne.

I am sorry to see the resources of the Linnean Society employed in publishing a memoir the conclusions of which, although startling in their novelty, are undeniably based upon the mistaken interpretation of defective preparations.

I think it is important that the Fellows of the Linnean Society should know whether the memoir now published is the same which was read a year or two ago at the Royal Society, and whether the Council of the Royal Society took any steps to ascertain the value of Mr. Lowne's preparations, or came to any decision as to the fitness of Mr. Lowne's paper for publication.

March 14
E. RAY LANKESTER

On the Terminology of the Mathematical Theory of Elasticity

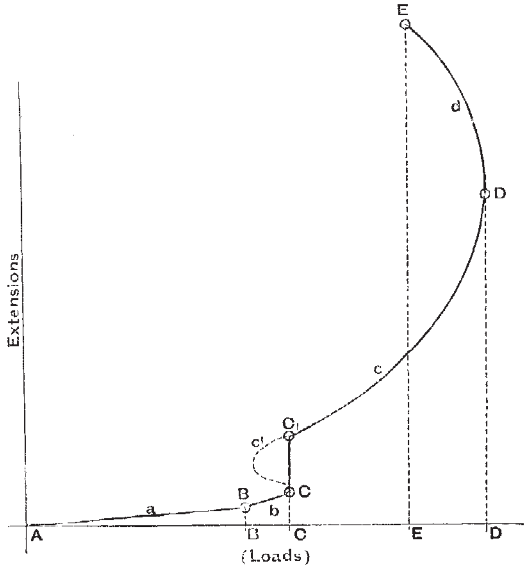
ENGINEERS quite as much as "elasticians" have reason to want some such terminology as that sought by Prof. Pearson (NATURE, vol. xxxi. p. 456), and have equal reason to be indebted to him for undertaking the work which he has at present in hand, which seems already to have given results of practical value as great as their scientific interest.

As I have for some years made a study of the physical side of the problems mentioned by him, I should be glad to make some suggestions as to terminology as contributions to the discussion of the subject in your columns. I will confine what I have to say to what may be called ductile materials (such as wrought iron, ordinary steel, copper, &c.), because in these only the whole phenomena are visible. The behaviour of such material in tension is illustrated by the accompanying figure, in which stresses are measured along the horizontal, and strains along the vertical axis.

It is extremely rare to obtain a piece of raw material already in a *state of ease*. *Wire*, of course, is highly strained by its process of manufacture, but that even ordinary bar and plate is also slightly strained, is shown in the manner mentioned by Prof. Pearson. Such initial strains as become visible as *set* by the first stretching up to any load (within limit of elasticity) disappear after one or two applications of that load. The material is then in a state of ease up to that load, but higher loads (still within the limit), on their first application, generally produce more set—the state of ease thus extending only to the stress employed to produce it. The *sets* are, along with the elastic strain, proportional to the stress, their effect being simply to lower the modulus of elasticity. Probably the process of *annealing* will bring the material into a state of ease for all loads at which such a state is possible. I propose to examine this matter further by aid, if possible, of the apparatus described by Prof. D. E. Hughes in the Inst. M. Eng. *Proc.*, 1883, p. 73. In the figure, *a* represents this *condition of perfect elasticity* (maximum state of ease being presupposed) and B, the superior limit of this condition, is the mathematical *limit of perfect elasticity.*

After B comes a stage *b*, within which the set is *not* proportional to the stress, although it still remains small; the total extension, therefore, increases faster than the stress. Occasionally this stage does not occur at all, and both its higher and lower limits seem—more than any other points in the life of the material—to be susceptible of change depending on manipulation. Accidental shock will shorten the stage considerably; very gradual loading extends it somewhat. For these and other reasons I therefore suggest that this stage be called the *condition of instability*, or of *unstable equilibrium*.

This condition terminates at C, in what I have called a "breaking-down" in the paper referred to by Prof. Pearson, in which paper I believe the phenomenon was described for the first time. This point is the one called by engineers the limit of elasticity, because it is the only one markedly visible without special apparatus. (The extension at B, on a length of 10 inches, may be about 0·01 inch; at C 0·03 inch and at C_1, same stress, it increases to 0·20, 0·25, and even occasionally 0·4 inch.) If "breaking-down point" be too crude a name, I would suggest *limit of stability*. It should be noted that the stress at this point does not remain constant, but in reality appears to diminish as the extension goes on, as shown at *c′* (this dotted curve not drawn to scale), a matter on which I am at present experimenting. I should add that, during the application of load at this point, extension appears to be occurring at different parts of the length *successively*, and not at all parts simultaneously, as during conditions *a* and *c*.



In the next stage, C to D, the whole strains consist of a very small elastic portion (apparently closely following the modulus), and a very large set, increasing much faster than the stress. The test bar remains at each load practically constant in its cross-section at all points of its length, and rises in temperature instead of (as in condition *a*) cooling. I would suggest for this stage the name *condition of uniform flow*, the physical applicability of which will be obvious to any one who has seen ductile metal in this condition.

At some point, D, a maximum load is reached, and at *about* the same point (generally, I think, a little earlier, but the difference is small, and not very easy to get at with certainty) the metal begins to flow *locally*, a part becoming much more reduced in cross-section than the rest, and eventually fracture occurs at this place under a less load than D, but with a greater extension, as at E. This final stage, *d*, might be called *condition of local flow*. The loads D and E (as Prof. Pearson suggests) would be *maximum* and *terminal* loads respectively). (Their difference was first pointed out, I think, by Mr. Daniel Adamson's experiments, *Journal* I. and S. Inst., 1878). The maximum *intensity* of stress

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